



September 25, 2014

George T. Angelone, Executive Director
Legislative Services Agency
200 W. Washington Street, Suite 301
Indianapolis, Indiana 46204

RE: HEA1378 Familial DNA Report

Director Angelone,

In the most previous legislative session the following language was enacted:

IC 2-5-33.4-14 Sec. 14. (a) During the legislative interim in 2014, the state police department shall make a report to the committee, or another appropriate study committee as determined by the legislative council, concerning familial DNA searches in criminal investigations. The report must include:

- (1) an analysis of the laws, policies, and procedures of other states concerning familial DNA in criminal investigations;**
 - (2) a recommendation on whether or not the committee should propose legislation concerning familial DNA in criminal investigations; and**
 - (3) if the state police department recommends legislation, recommendations regarding:**
 - (A) the appropriate safeguards to ensure scientific accuracy; and**
 - (B) confidentiality standards; for familial DNA searches.**
- (b) This section expires December 31, 2014.**

Please find attached with this correspondence the Indiana State Police Department's comprehensive Familial DNA Search Report as required by HEA1378. Should you have any questions or need anything further on this document, please do not hesitate to contact my office at (317) 232-8242. I hope this letter finds you well, and I look forward to a continued agency partnership for many years to come.

Yours in Service,

A handwritten signature in blue ink, appearing to read "D. G. Carter", is written over the typed name.

Douglas G. Carter, Superintendent
Indiana State Police

Attachment

September 9, 2014

TO: Douglas G. Carter
Superintendent

FROM: Steven D. Holland, Major
Commander, Laboratory Division

SUBJECT: Familial DNA Search Recommendation

The Indiana State Police Laboratory Division has conducted a review of the current state of familial DNA searching in the United States per requirements of HEA 1378 passed during the 2014 legislative session. Familial DNA searching is a separate search of offender profiles for the purpose of identifying potential relatives of the source of a crime scene sample. Familial DNA searching is a comparatively new investigative tool, which is not widely used and has no generally accepted procedures. New technology is needed to make the process more effective. While a familial search has the potential to solve crimes, the success rate is very low and the process requires significant resources.

The current state of familial searching in the United States is in flux. There are no established national standards, protocols, guidelines, search software or training materials available or in use across the country. The software that is currently in use has not been professionally developed and tested. Unlike the CODIS system, which is closely controlled and regulated by the FBI for all 50 states, neither the FBI nor any other federal entity has taken control or given guidance other than to affirm that familial searching will not be conducted at the national level.

Currently, there are four states or agencies that have well-established familial searching programs in place. A few other states have developed pilot programs, or are in the process of developing a program. While there are some similarities among programs, there is also wide variation among states. Most state crime labs have not yet adopted familial searching.

Technology advancements are needed to improve the effectiveness of familial searching. Male specific DNA testing (YSTR) is commonly used to evaluate search results for male DNA profiles, but additional YSTR markers are needed to make the process more effective. No similar technology is available for cases involving female perpetrators or to search for female relatives. With time, better software tools and technologies may improve the effectiveness of this technique.

Each of the four states that use familial searching has solved crimes that may never have been solved otherwise, but the success rate for solving crimes by familial searching has been under 5%. It should be noted, however, that the resources needed to conduct a familial search are significant. In addition to laboratory personnel time, supplies and equipment; significant investigative resources are also needed. A familial search does not result in an exact match to a perpetrator, but only indicates a possible relative of the perpetrator. Much investigative time is needed to verify the legitimacy of this lead after the name is released.

Due to the limitations noted above, the Laboratory Division staff does not support instituting a familial DNA program in Indiana at this time. Familial DNA searching has the potential to be an effective tool in solving crime in the future. It is suggested that we observe the development of new or improved familial DNA tools and establishment of broadly accepted protocols and standards over the next few years with the intent of developing a better program in Indiana when technology advances.

Respectfully submitted,



Steven D. Holland
Major

THE STATE OF FAMILIAL SEARCHING IN THE U.S.

The Combined DNA Index System (CODIS) is a computer database of DNA profiles used to solve crimes across the United States. In Indiana, DNA profiles from offenders convicted of a felony can be entered into CODIS as well as DNA profiles from crime scene evidence and missing persons/unidentified remains types of cases. The purpose of the database is to generate investigative leads by identifying matches between these categories. A continued "life of crime" or the high incidence of recidivism in criminals is the concept upon which the DNA database program is based. If a convicted offender's profile matches crime scene evidence, this can identify a potential suspect(s). The database can also link multiple unsolved crimes to identify serial offenses and connect agencies who can then work together in the investigation.

A familial search is a separate search performed against the convicted offender DNA profiles generated for CODIS. This search is done for the specific purpose of trying to detect convicted offenders that might be biological relatives of the source of the crime scene DNA. This search involves a single crime scene profile and is performed once as the result of a specific request. It is not a CODIS search. It is not done with CODIS software. It is not an on-going, routine, national search like those currently done by CODIS. Familial searching is based on the concept that biological relatives have DNA profiles that are more similar to one another than the DNA profiles of non-relatives. If the crime scene profile is not exactly the same, but very similar to the profile of an offender, it is possible that the offender is related to a person who is the source of the crime scene profile.

While it is possible to generate leads in this way, there are many limitations with this technology at present. Fbi.gov indicates familial searching is being performed in four states: California, Texas, Colorado and Virginia. In these states, the success rate for this technique has been less than 5%. It is prohibited by law in Maryland and the District of Columbia.

Information presented here is available at www.denverda.org/dna/dna_index.htm or www.fbi.gov, or was gathered from discussions at various forensic meetings, trainings and webinars.

THE SCIENCE

The exact amount of similarity between DNA profiles of relatives can vary, making it hard to determine by DNA alone if and how two people are truly related. Each person has two copies of DNA, one from their mother and one from their father. So if, for example, a mother has DNA of types A and B and the father has types C and D, they will each randomly pass one of their types to each of their children. Child #1 could inherit A and C, then child #2 could also inherit A and C, but child #3 might inherit B and D. This type of inheritance takes place at each of the 15 DNA locations examined by the Indiana State Police Laboratory. This randomness makes it difficult to predict how much DNA even two full brothers may have in common. Related people are more likely to have some DNA in common than compared to the general population since, in this example; they could not inherit types E, F, G or H. This is far from an exact science and must be treated as such.

A software program other than CODIS is needed for this type of search. CODIS is designed to find exact matches, not the type of "similar" DNA profiles that can exist between close relatives. In fact, some studies have suggested that the way CODIS searches profiles against each other, it would miss full siblings actually present in the search 99% of the time. In recent years, new software has been developed, making familial searching a real possibility. The database of convicted offender profiles can be exported from CODIS and imported into the familial searching program. The software being used by other states was developed and written in-house. It is unknown if any appropriate software is available for purchase or which states would be willing to release their software to the Indiana State Police.

It is important to realize this is not the same type of matching as traditional database searches and inherently involves ambiguity and uncertainty. These software programs identify similarities, not matches. The search of a single DNA profile typically results in hundreds, potentially thousands of candidates, most of whom will be unrelated to the perpetrator of the crime. These candidates can be ranked using kinship statistics. The Scientific Working Group on DNA Analysis Methods (SWGDM) has published recommendations for familial searching. One of the recommendations was to evaluate candidate matches using a Kinship Likelihood Ratio (LR). The Kinship LR is a mathematical model that calculates the likelihood of the two DNA profiles in question being related versus the two DNA profiles being unrelated. The higher the LR, the more likely those individuals are relatives. However, there is no magic number that ensures two people are or are not related. In the case of Child #3 in the above example, he might have a very low LR when compared to his siblings.

While statistics are helpful, a true relative may not necessarily be ranked at the top of the list. During California's validation of their familial searching protocol, they saw only 61% of full siblings (such as brothers) known to be present identified by the search. So even if a relative is in the database, it may not be returned or highly ranked by a familial search. On the other hand, if there is no relative present in the database, the search will still return ranked candidates who, in that case, are not true relatives. Additional methods must be used to either support or refute the potential that any given candidate match is actually a relative.

The most straightforward method is to perform a second type of DNA analysis that looks at lineage markers. Every female has two X chromosomes that are inherited the same way as discussed above. Every male has one X from his mother and one Y from his father. Since there is only one Y available, it gets passed to all male offspring. YSTR testing analyzes DNA found on the Y chromosome. Since this DNA is passed down along paternal lines, all male paternal relatives have the same YSTR profile. After a familial search is performed, YSTR testing is often done on a subset of candidates that rank high statistically, meaning they have a better chance of being a relative. Many (sometimes all) of the candidates can be ruled out if the YSTR profile is different than the YSTR profile of the crime scene sample. It should be noted that a consistent YSTR profile does not confirm close relatedness. Two people sharing a YSTR profile could be very far apart on their family tree. This type of analysis does not have the same discrimination capabilities of traditional forensic DNA testing and the population databases are not large enough yet to truly know how unique a family's YSTR profile may be. Finally, since the Y chromosome is being examined, this additional testing does not assist in determining maternal relatives, female relatives or relatives of female perpetrators.

THE LIMITATIONS

Because there is already so much ambiguity in this type of searching, it is vital the profile being searched is very straightforward and of high quality. Mixtures of DNA from multiple people or partial DNA profiles should not be used for familial searching. The evidence must provide a full single source DNA profile for both the regular (autosomal) DNA testing and YSTR typing.

Unlike CODIS, which maintains the profiles and searches them against new entries every week, this deliberate export of offender profiles from CODIS into the familial searching software would create a single search against only those offenders present in the database at that point in time. Any offenders entered into CODIS after that would not be compared. Also, NDIS does not perform familial searches so relatives who may be convicted in neighboring states would not be included in the search.

The software programs that have been developed are only designed to look for first order relatives. This means parents, children and full siblings. When you begin to look beyond that to uncles, grandparents, cousins, etc, the genetics become much more complicated.

There are concerns that investigation of entire families was not the original intent of the database statutes and therefore could raise legal arguments against its constitutionality. CODIS databasing of convicted offenders has repeatedly been upheld by the courts on the grounds that the convicted individual has a lowered expectation of privacy. Some argue that if the use of that DNA sample is expanded to investigate family members, that lowered right of privacy is being extended to individuals who have not gone through due process. This could be seen as a violation of the 4th amendment which prohibits unreasonable search without probable cause. Some even view this progression as moving toward a universal database with DNA collections done at birth.

Along with the specific 4th amendment concerns, there are broader social perceptions that need to be considered. Familial searching may be seen by the public as "genetic surveillance" or the sins of the father being visited on the son. A police investigation involving law abiding branches of the family could potentially affect how they are viewed by their community. Some note that CODIS is statistically racially disproportionate and the extension into families of those in CODIS would exacerbate that disproportionally.

Finally, lineage testing could reveal family secrets. Genetic families are not always the same as social families. Familial search practices could divulge otherwise hidden information about true parentage or adoption. A family might discover that an assumed relationship is not factual or they might learn of a relationship previously unknown to them. It may also be that the family was unaware their relative was a convicted felon. These revelations can have a profound ripple effect across extended family relationships, not just those being investigated. Such situations can be emotionally challenging, even destabilizing to the family and must be handled sensitively.

THE IMPLEMENTATION

A familial search is time consuming and more expensive than other types of DNA analysis. Several steps would need to be taken even before the first search could be done. The Indiana State Police Laboratory Division would need to research and evaluate all software options. Depending on the option chosen, funds may need to be secured for its purchase, which often would need to be included in a budget one or two years ahead of the purchase. Once software was obtained, laboratory personnel would need to undergo training in its use from the provider.

As per the Quality Assurance Standards, which are nationally used to audit forensic DNA laboratories, any laboratory wishing to implement a familial searching program would first be required to perform validations and develop written procedures. Validation is the process of testing a new procedure, instrument, or software program in order to evaluate its efficacy and reliability. Test data from known sources is used to determine if the expected answers are obtained with that method or what limitations the procedure has. In the case of familial searching, many laboratories have created simulated databases with virtual DNA profiles that mimic the genetic possibilities of relatives. They then use these to test the software. Over multiple searches, data is gathered on where in the search results any of the known "relatives" may rank and what statistics they produce. This information then guides decisions such as which and how many candidates the lab will test with YSTRs after future real searches.

At the conclusion of the validation studies, detailed protocols concerning what profiles will be searched and how results will be evaluated and reported must then be written. The privacy concerns and agency resources discussed here make it impossible to use familial searching as a routine part of the over 4,000 biology cases submitted to the ISPL annually. Limited application of the technology is necessary due to the laboratory time and resources required. While ISP would not expect to hire additional staff positions for familial searching, each search performed would involve multiple laboratory analysts, taking their time away from regular casework and negatively affecting that backlog. Keeping these things in mind, the protocols developed would need to address which cases would qualify for a familial search, who would make the determination of whether or not to do the search, how many candidates would receive further evaluation, what types of evaluation would be done, and how the results would be communicated to the investigating agency.

It is clear that YSTR testing of CODIS offender samples would be a key component of any familial searching program. Currently, the Indiana State Police Laboratory CODIS Unit does not have the equipment or procedures needed to perform YSTR analysis. There are two ways this could be handled. The initial steps of the analysis (extraction and quantification) could be performed by the casework laboratory. It is unknown how much this may potentially interrupt their workflow or delay the analyses of case samples. Alternatively, equipment could be purchased to allow the CODIS Unit to do the testing. The needed equipment would total approximately \$95,000. Regardless of which of these approaches may be used, YSTR testing costs approximately \$40 per offender candidate in consumables and reagents. If 175 candidates were tested, this step in the process equals \$7,000 for each familial search, not including wages for the time spent by the analysts.

The final component that would be needed to begin a familial searching program in Indiana is training. Laboratory staff chosen to be involved would be trained in use of the software, kinship statistics and possibly YSTR testing. In accordance with the afore mentioned Quality Assurance Standards, they would need to pass a competency test in each of these areas and from that point on they would be required to take a proficiency test twice a year.

Training for law enforcement would also be needed. They need to understand what the results mean, do not mean, and how that may affect what they do next. Initially, the ISP laboratory would need to conduct broad training on this topic statewide so investigating agencies and prosecutors could gain a basic understanding of this new laboratory technique and know how to request its use. Once a particular agency requests a search, their investigators will need additional training in what type of information they will be given and the next steps to take. Another topic that would need to be addressed in this second training may be what to do if a family secret is revealed and how people may react, similar to what a genetic counselor might encounter. All of this training should be planned in advance so that personnel can be prepared with the information needed when that first meeting occurs.

All of the requirements outlined here for implementation of a familial searching program would likely take more than a year to complete.

SPECIFICS OF EACH STATE'S POLICIES

Virginia

The Commonwealth of Virginia has made its policies and protocols publicly available on <http://www.dfs.virginia.gov/laboratory-forensic-services/biology/familial-searches/> and are the source of the information below.

A familial search is only considered when all other means of investigation of a violent crime against a person have been exhausted. The search must be requested by the chief law enforcement officer of the investigating agency and agreed upon by the Department of Forensic Science Director, Biology Program Manager and the Commonwealth's Attorney with jurisdiction. The DNA profile itself must be of good quality and provide a full single source profile for both autosomal and YSTRs.

The resulting list of candidates is sorted twice, one for possible parent-child relationships and once for sibling relationships. This is done based on the statistical likelihood of that relationship for each of the three main populations (Caucasian, Black and Hispanic). The top 15 parent-child candidates and top 50 sibling candidates from each population (for a total of 195 offender samples) are taken for YSTR analysis. Only if the YSTR profile matches will the name of that offender be considered for release to the law enforcement agency.

Virginia began familial searching in 2011 and has had one case result in a conviction thus far.

Texas

Familial searching is performed by the Texas Department of Public Safety.

Like Virginia, a familial search is only considered when all other investigative leads have been exhausted. The profile to be searched must be from an unsolved violent crime with a level of certainty that the profile is relevant to the perpetrator. The search must be requested jointly by the investigating agency and district attorney to show intent to further investigate if a name is released as a result of the search. The request must then be approved by the CODIS Program Manager, CODIS Technical Leader, CODIS Y-STR analysts, Assistant Directors and Director of the Laboratory. The DNA profile itself must be CODIS eligible, of good quality and provide a full single source profile for both autosomal and YSTRs.

Once the search is performed, a population geneticist is consulted for evaluation of the results. After this consultation, candidates are chosen for Y-STR testing. If the YSTR profile matches, non-DNA information such as the existence of relatives living in the area may be reviewed as well. Only then will the name of the offender be considered for release to the law enforcement agency.

Texas began familial searching in 2010 and has had one successful outcome to date.

Colorado

Denver Police Department and the Colorado Bureau of Investigation work together to perform familial searching.

A familial search may be requested for any type of crime having significant public safety concerns. The preferred method of request is a joint request from the chief law enforcement officer and the district attorney. Again, it must be a full, single source profile for searching. Policy states that standard investigative leads should be exhausted or, if an exception is needed, it should be articulated. YSTR testing is performed on a subset of candidates that meet a statistical threshold. If a female candidate has a high statistical chance of being a relative, she may be investigated by traditional police means.

Colorado Bureau of Investigation not only requires the agency to agree that they will pursue the case should information about a potential relative be released, but the lead investigator is required to receive training in the use of familial searches. It is stressed that full background checks and investigations of the individuals of interest should be performed using public and law enforcement databases. Any decision to contact the family members and obtain DNA standards should be based on these investigations, not solely familial DNA evidence.

The Colorado Bureau of Investigation has had a familial searching policy in place since 2009. There have been two convictions out of 90 cases searched.

California

Familial searching is performed by the California Department of Justice (CAL-DOJ).

A Memorandum of Understanding (MOU) is established between the investigating agency requesting the search and CAL-DOJ. The MOU verifies that investigative leads have been exhausted and the agency and prosecutor's office are committed to further investigation following the familial search. Searches are performed on single source, complete DNA profiles with YSTR data available. YSTR analysis is done on up to 168 candidates according to their statistical rank.

Non-genetic investigation on candidates is performed by the Bureau of Investigation and Intelligence to confirm the existence of relatives to that offender and whether or not it is possible they could have committed the crime. Cases are chosen, and results evaluated, by a Familial Searching Committee, who has final determination whether any names will be released. This release is accomplished via a meeting with CAL-DOJ, the investigating agency, the prosecutor and the laboratory that analyzed the crime scene evidence.

California has been performing familial searching since 2008, identifying four suspects thus far, which affected 26 cases total due to serial offenses.

LABORATORY IMPACT

Planning and Development – Estimated Time – 1 year

Selection, Procurement and Validation of Familial Searching Software

Currently no professionally developed and tested software is commercially available. Software will have to be developed in-house or obtained from another crime lab if possible. Once obtained the software must be tested and validated. A computer will need to be purchased to maintain and operate the search software.

Establish Protocols

Based on the validations, protocols must be established and incorporated in the laboratory test methods, training manuals, quality manual and physical evidence bulletins. A case selection process will also need to be developed.

Training and Preparation - Estimated Time – 6 months

Laboratory Training

Analysts and supervisors in the lab that will be involved in familial searching will need to be trained and competency tested in the adopted procedures. This may require some outside training in the statistics of familial relationships as well.

Police and Prosecutor Training

ISP will need to conduct training about this new tool and the requirements and criteria for requesting its use. Additionally, should a search result in release of the name of a possible relative of the perpetrator, additional training will be necessary on the follow up investigation.

Procurement of Supplies

At a minimum YSTR DNA kits will be needed for testing of the offenders that rank the highest in the relatedness search. Other miscellaneous lab supplies will also be used.

Implementation – Estimate time - Each Case May Take 2-4 Weeks to Complete

Request from Agency

A law enforcement agency will need to initiate a familial search with a request to ISP. The agency and prosecutor have to agree to pursue the case should it result in a relative being identified.

Decision Process

ISP will use the predetermined selection process to accept or reject the case. Other states use a committee with closely defined membership to make this decision.

Familial Search

ISP will transfer offender profiles from CODIS to the new software and conduct the familial search. Results will rank offenders by likelihood of relatedness.

Laboratory Testing

YSTR analysis and any other appropriate testing will be conducted on the offenders most highly ranked. Non-genetic information may also be investigated.

Notification

Names of offender(s) with matching YSTR profiles will be provided to the requesting agency for follow up.

Budgetary Considerations

Software and Equipment

Familial Searching Software - Cost unknown. Currently this software is not commercially available, but may be available from another state. Computer - \$1,000

Supplies

Supplies will cost approximately \$7,000 for each search. This includes YSTR kits and miscellaneous items.

Staffing

ISP can implement this program without additional staff. It should be noted that this will require a significant number of employee hours to develop and implement. Time spent on this project will detract from other duties such as regular casework and supervision and thus will have a negative impact on backlogs and turnaround time.

Planning and Development

It is estimated that the CODIS Supervisor will spend one day per week over the course of one year developing a familial search program. $1 \text{ day/week} \times 50 \text{ weeks} \times 7.5 \text{ hours/day} \times \$40.00/\text{hour} = \$15,000$.

Training and Preparation

It is estimated that it will take one week to develop a training program for police and prosecutors. $37.5 \text{ hours} \times \$30/\text{hour} = \$1,500$. Each presentation of the training will take the presenter out of the laboratory for one day. $7.5 \text{ hours} \times \$30/\text{hour} = \$225/\text{session}$.

Implementation

It is estimated that each search will require one analyst to dedicate 2 weeks of work time in addition to time for supervisors and Laboratory Division staff. $2 \text{ weeks} \times 37.5 \text{ hours/week} \times \$30/\text{hour} = \$2250$.

REQUESTING AGENCY IMPACT

Investigative Time

After the agency receives the name(s) of an offender with a possible male relative that may be involved in the crime, it will be necessary for the agency to invest considerable effort to verify the information. The amount of time necessary will depend on the details of each case.